

HABITATS AND LIVING RESOURCES

The waters off the Pacific coast are among the richest in biological diversity, or biodiversity, in United States coastal waters. California's living marine resources depend on the health of the entire ocean ecosystem to support thousands of flora and fauna species. This ecosystem includes habitats located within inland, enclosed, nearshore, and offshore waters. A variety of ocean and coastal industries, including fishing, marine aquaculture, biotechnology, tourism, and recreation, depend on the maintenance and enhancement of California's ocean and coastal habitats and living resources. These resources, and the economic base they support, will benefit substantially from the development of a comprehensive program to sustain California's ocean ecosystem into the 21st century and beyond.

This chapter addresses six issues related to ocean and coastal habitats and living resources:

- *Ocean Ecosystem Management: developing methods to manage California's entire ocean ecosystem, and the habitats that support this system.*
- *Ocean and Coastal Managed Areas: evaluating the ability of California's complex system of ocean and coastal managed areas (such as reserves, refuges, and State parks) to achieve a healthy and productive ocean ecosystem.*
- *Fishery Resources: developing a comprehensive approach to maintain sustainable fishery stocks off the California coast.*
- *California's Marine Aquaculture Industry: evaluating the potential of aquaculture to supplement the growing demand for seafood and aquatic products, as well as assisting re-stocking programs.*
- *Marine Mammal Populations: evaluating management issues raised by some increasing populations of marine mammal species in coastal waters.*
- *Non-Native Plant and Animal Species: examining the introduction of non-native species to the ocean ecosystem and developing strategies for addressing problems caused by their introduction and establishment.*

BACKGROUND

Responsibility for protecting California's ocean and coastal habitats and living resources is delegated among a variety of State agencies pursuant to various sections of California code. For example, the Fish and Game Code requires the California Department of Fish and Game (DFG) to protect, maintain and enhance populations and habitats of marine plants, invertebrates, fish, mammals, and birds, and to support the multiple use of these resources. The Public Resources Code requires the California Department of Parks and Recreation to preserve coastal areas containing ecological, geological, scenic, or cultural resources of significant value. The California Coastal Act requires the California Coastal Commission to apply a broad range of ocean and coastal resource protection policies to development proposals within the coastal zone. The State Coastal Conservancy is authorized by State law to acquire and restore coastal wetlands, riparian corridors and stream habitats to facilitate non-regulatory approaches to habitat protection, restoration, or enhancement. Several State and federal statutes require the State Water Resources Control and Regional Water Quality Control Boards to maintain the integrity of the State's

waters. Other State agencies are also involved in ocean and coastal habitats and living resources management. State agency responsibilities are presented in more detail in the chapter titled, *Ocean Jurisdiction and Management* and Appendix C.

At the federal level, ocean and coastal habitats and living resources management roles have also been delegated to several agencies. For instance, wildlife management responsibilities are divided between the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). The NMFS has major responsibilities for fisheries and marine mammal management, while sea otters and some federal fish hatcheries remain within the jurisdiction of the USFWS. Other federal agencies, such as the U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers, U.S. Coast Guard, Minerals Management Service, and National Oceanic and Atmospheric Administration (NOAA), have ocean management responsibilities which vary, depending on the type and location of the resource or activity. Summaries of the role federal agencies play in managing and protecting ocean and coastal habitats and living resources are in the chapter titled, *Ocean Jurisdiction and Management* and Appendix D.

Many State and federal agencies are responsible for implementing issue-specific (and sometimes single-purpose) provisions relating to ocean and coastal habitats and living resources. This issue-specific approach occurs because legislation is often produced incrementally to address immediate technical problems. The result is management efforts based on geography, species type, or impact source, rather than the development of broader policy objectives. However, ocean and coastal species and the ecosystem that supports them do not adhere to political boundaries; therefore, it makes little sense to limit management efforts in such a fashion.

ISSUE ANALYSIS

Ocean Ecosystem Management

Both the State of California and federal government are seeking to manage natural resources on an ecosystem basis. A critical first step to ocean ecosystem management is understanding the ecological and institutional aspects of the system and their interactions. Lack of understanding about biological, social, economic, and political processes that affect the ocean ecosystem hinders the ability to develop and implement sustainable resource management policies. The ecosystem approach suggested in this Agenda will help achieve the California Ocean Resource Management Program's mission:

“To ensure comprehensive and coordinated management, conservation and enhancement of California's ocean resources for their intrinsic value and for the benefit of current and future generations.”

Key components of an ecosystem approach include:

- ***Recognizing the Interdependence of Ocean Resource Zones and Species.*** California's ocean ecosystem (described in Chapter 4) includes an inland watershed zone with streams and rivers draining much of the State's interior, connected to the enclosed waters, nearshore ocean, and finally the deep ocean waters of the offshore ocean zone. It is critical that the relationships between these zones provide a major basis for future planning and management to protect the overall health of the ocean ecosystem. This can often be difficult because parts of an ecosystem are usually planned and managed by people and institutions with different goals, objectives, and methods from those planning and managing other parts of it.
- ***Focusing on Habitats and Multiple Species.*** Management intended to sustain entire ecosystems must be based on larger habitats and multiple species, focusing on maintenance of the ecosystem's natural flows, structure, and cycles, rather than the traditional emphasis of protecting individual

elements, such as a specific species or a natural feature. A whole or complete ecosystem is one in which the boundaries provide sufficient area, diversity, complexity, and linkages to other ecological units to sustain the system in the long-term. Biological diversity cannot be maintained in small segments of the ocean, one intertidal area, one wetland, or part of a watershed. For these reasons, the numerous species that depend on California's ocean ecosystem will be better served in the long-term by broad habitat management and protection measures rather than an exclusive focus on single-species approaches.

- ***Building Consensus-Based Solutions.*** California's existing system of ocean governance is substantially based on single-purpose management approaches and in many cases is highly fragmented. However, the causes of ecosystem degradation are many and often subtle, requiring an analysis of the ecosystem's broader needs with the involvement of multiple stakeholders as early as possible. Particular emphasis should be placed on developing approaches at the local level with the flexibility to adapt and respond to new issues and problems as they arise.

Although ecosystem management efforts can be time-consuming to implement, the intent is to develop long-term consensus-based approaches that will last. This will require integrating existing, narrowly-focused jurisdictions to address the larger needs of California's ocean ecosystem. A variety of programs currently in place incorporate ecosystem management approaches and are producing positive results. Several ongoing efforts provide examples of such approaches.

Protecting Biological Diversity. The California Biodiversity Council (Biodiversity Council), an interagency organization of federal, State, and local government agencies, and the University of California, facilitates communication and cooperation between resource management and conservation planning efforts to promote biological diversity protection in California. The Biodiversity Council has supported coordination of many activities, including watershed and stream restoration projects, soil erosion and fire hazards management plans, and coastal sage scrub habitat protection efforts. Although the initial geographic focus is within the inland watershed zone, Biodiversity Council efforts benefit both inland and ocean resources. In fact, the relationship between land and sea was the focus of the March 1996 Biodiversity Council meeting in Monterey, which included two days of presentations identifying, describing, and promoting innovative new approaches to land/sea management issues. The Biodiversity Council also serves as a forum to support the California Environmental Resources Evaluation System (CERES) located within the Resources Agency. The CERES makes accessible through the Internet information about California's natural resources including vegetation, wildlife, marine resources, and land use by bioregion, which will assist in the management of California's entire ocean ecosystem. The Internet address for CERES is <http://ceres.ca.gov>.

Reducing Polluted Runoff. The State of California, the federal government, and the Association of Monterey Bay Area Governments developed a Memorandum of Understanding to provide ecosystem based water quality management measures to protect Monterey Bay National Marine Sanctuary waters. As a result, a major interagency effort, coordinated by the NOAA, is underway to create a regional water quality protection program for the Sanctuary. The NOAA is providing technical support to implement a process known as integrated coastal management, in which federal, State, and local agencies, industries, and public interest groups develop a consensus-based management plan. This effort uses ecosystem management principles by evaluating entire watersheds located within multiple jurisdictions and by including major interested parties in the planning process. The Monterey Bay National Marine Sanctuary water quality process is described in more detail in the chapter titled, *Ocean Jurisdiction and Management*.

Protecting Wetlands and Subtidal Resources. Governor Wilson issued an executive order in 1993 which mandates a new policy and approach to managing California's wetlands (Executive Order W-59-93). The California Wetlands Conservation Policy recognizes the critical role that wetlands play in California's ocean ecosystem and is geared toward building the partnerships necessary to protect these resources. The policy is being implemented through programs and initiatives designed to meet three primary objectives:

1. To ensure no overall net loss of wetlands, and achieve a long-term net gain in the quantity, quality, and permanence of wetland acreage and values in California in a manner that fosters creativity, stewardship and respect for private property.
2. To reduce procedural complexity in the administration of State and federal wetlands conservation programs.
3. To encourage partnerships to make restoration, landowner incentive programs and cooperative planning efforts the primary focus of wetlands conservation and restoration.

The Governor's Wetlands Policy is discussed in more detail in the chapter titled, *Ocean Jurisdiction and Management*.

Port Development and Resource Protection. A process known as the Long Term Management Strategy (LTMS) is being used in San Francisco Bay to bring together key government, non-profit, and private sector interests to develop a 50-year strategy to help meet the development needs of San Francisco Bay ports in an environmentally sound manner. This process is working to establish a consensus regarding the disposal of dredge spoils using a combination of methods, including such options as deep ocean disposal, land disposal, and using the spoils to create shallow wetland and subtidal habitat. The LTMS involves multiple jurisdictions, land owners, commercial interests, and environmental interests, and solutions which will affect all four zones making up California's ocean ecosystem. The LTMS is described in more detail in the chapter titled, *Ports and Harbors*.

The four programs and strategies described above incorporate ecosystem planning approaches to ocean resource management and protection. The examples given do not adhere to any specific criteria and were established to achieve different goals. However, they all include consensus-based processes intended to reduce duplication, include interested parties as early as possible, and consider the needs, relationships and interdependence of multiple species and habitats. It will be important to coordinate these efforts already started, expand them where necessary, and determine where additional programs should be initiated as such efforts will help achieve the State of California's mission to ensure comprehensive and coordinated management of ocean resources for the benefit of current and future generations.

Ocean and Coastal Managed Areas

The State of California, federal government, and various local governments have created a complex assemblage of ocean and coastal reserves, refuges, parks, sanctuaries, and other designated management areas along the coast and within both State and federal waters. These designations result from a mixture of legislative and administrative actions intended to protect, conserve, or otherwise manage a variety of habitats while balancing such ocean uses as commercial fishing, recreation, and research. These areas did not result from a comprehensive plan to manage California's ocean resources, but instead were created over the years through case-by-case actions usually intended to address specific management objectives.

This system of ocean and coastal managed areas can be confusing as there is a plethora of designations by numerous agencies, with frequently little difference between allowable uses in different categories. For instance, when comparing marine refuges and reserves, a DFG report states, "The net effect of these . . . laws and regulations is that we now have only minor differences between the regulations governing the use of refuges and reserves established by the Legislature and the Fish and Game Commission" (DFG 1989). A similar conclusion was also voiced in public comments received during the development of this Agenda. The practical problem for the public, and sometimes even resource managers, is confusion over what is allowable in each designated area. This may indicate a need to revise and simplify the system to make it more easily understood, or perhaps increase education in the field with additional signs, field docents, or enforcement personnel.

Confusion about requirements, restrictions, or boundaries of the State's ocean and coastal managed areas is compounded by that fact that there is no single reference document which includes basic information about the different designations. The UC Cooperative Extension Sea Grant Marine Advisory Program is creating a database of California marine protected areas (MPAs), a subset of ocean and coastal managed areas described in this subchapter. The Sea Grant Cooperative Extension database will only include information about those areas which are tidally influenced or, in essence, covered by seawater. Yet this database will be the first step in assisting resource managers, researchers, and resource users in better understanding California's ocean and coastal managed areas. The database will include classification type, county location, date established, responsible agencies, management goals and objectives, fishing-related regulations, official boundaries, and uniform maps for the over 110 MPAs in California. Sea Grant Cooperative Extension, in cooperation with the Geography Department Remote Sensing Research Unit at UC Santa Barbara, is also using the database to create a GIS for all California MPA boundaries. When completed this information will be made available through a published guide and in a variety of computer formats, including through the Internet.

For existing ocean and coastal managed areas, many State and federal agencies report inadequate resources for properly enforcing restrictions within the designated areas. Unfortunately, no comprehensive interagency evaluation of the designations and management of this system has ever been conducted. Re-evaluating and altering the existing system and goals could help improve efficiency and allow personnel to focus on implementing the most important laws and regulations governing these areas.

The various categories of international, federal, State, and locally managed areas are summarized below. In addition, Appendix H describes the intent of State, federal and international designations and lists the agencies that promulgate, implement, or enforce regulations within them. Ocean and coastal managed areas are also displayed on maps in Appendix H to illustrate the extensive system currently in place. The categories include managed areas located offshore, as well as coastal lands located along the shoreline. Land designations are included because they have a substantial affect on the protection, conservation, and management of California's ocean resources.

International Ocean and Coastal Managed Areas. There are two internationally-recognized designations which include ocean and coastal sites in California:

- *Man and the Biosphere Reserves* are designated to foster harmonious relationships between humans and the biosphere through policy-relevant research which integrates the social, physical and biological sciences. The United Nations Educational, Scientific and Cultural Organization (UNESCO) is authorized to designate these reserves pursuant to nominations made at the local level.
- *The World Heritage List* was established through an international agreement and adopted by the General Conference of UNESCO in 1972. The World Heritage Committee is the statutory body responsible for designating natural and cultural sites with outstanding values which represent a common heritage, to be treasured and preserved as unique testimonies to an enduring past.

Federal Ocean and Coastal Managed Areas. The federal government has designated ocean and coastal managed areas along the California coast in the following categories:

- *A Federal Ecological Preserve* was designated in the Santa Barbara Channel after the 1969 oil spill on Unocal's Platform A which withdrew a portion of the Outer Continental Shelf from mineral leasing and reserves it for scientific, recreational, or other related uses.
- *National Estuaries* are designated to protect and improve water quality and enhance the living resources of nationally significant estuaries and bays threatened by pollution, development, or overuse. The program is administered by the USEPA under the Clean Water Act.

- *National Estuarine Research Reserves* are designated to preserve or restore estuarine areas of coastal waters affected by tidal flows. Administered by the NOAA, the program promotes and coordinates estuarine research, provides grants, and creates guidelines for research projects.
- *National Marine Sanctuaries* are designated to maintain discrete areas of special national significance to protect ocean resources while providing multiple uses. Oil and gas leasing is not permitted within any of the national marine sanctuaries located off the California coast. The program is administered by the NOAA.
- *National Parks (including National Natural Research Areas), National Monuments, National Recreational Areas and National Seashores* are all part of the National Park System and designated to conserve scenery, national and historic objects, and wildlife, and to provide for the enjoyment of these resources in a manner that will leave them unimpaired for future generations. Parks such as the Channel Islands National Park or the Redwood National Park include ocean and coastal resources of national significance, and are administered by the National Park Service.
- *National Wildlife Refuges* are designated to protect and conserve fish, wildlife, and waterfowl production areas. The USFWS manages these areas.

California Ocean and Coastal Managed Areas. California has many ocean and coastal management designations, and new categories continue to be proposed:

- *Areas of Special Biological Significance* are designated in State Tidelands and Submerged Lands to limit or prohibit discharges in their general proximity. These areas are designated by the State Water Resources Control Board through the Water Quality Control Plan for Ocean Waters of California.
- *The Coastal Sanctuary* prohibits oil and gas leasing within all State Tidelands and Submerged Lands and is administered by the State Lands Commission.
- *Ecological Reserves* are designated at over 25 sites along the California coast (including the four mandated by the Marine Resources Protection Act of 1990). The Fish and Game Commission is authorized to designate and periodically amend individual reserve uses and boundaries. The DFG manages the sites, which are preserved in a natural condition for the benefit of the general public to observe native flora and fauna and for scientific study.
 - *The Marine Resources Protection Act of 1990* restricts the use of four ecological reserves designated by the Fish and Game Commission to research relating to the management and enhancement of marine resources. The Legislature determined that recreational uses in these four ecological reserves, including hiking, walking, viewing, swimming, diving, surfing, and transient boating, are not in conflict with the purpose of the act.
 - *The Offshore Rocks and Pinnacles Ecological Reserve* protects thousands of offshore reefs, rocks and small islands along the California coast. Originally a federal program started in 1930, management of the reserve has been delegated to the DFG for 50 years pursuant to a 1983 Memorandum of Understanding between the State and U.S. Bureau of Land Management.
- *Refuges* have been designated by the Legislature for protecting birds, mammals, fish, amphibia or marine life along the California coast in five different categories (fish, game, quail, waterfowl and marine life refuges). The Fish and Game Commission is authorized to exercise control over all mammals, birds and fish in the refuges, while the DFG manages these areas.

- *Clam Refuges (named Pismo Clam Preserves by the Fish and Game Commission)* have been designated in three locations along the San Luis Obispo coastline. These refuges prohibit the taking of Pismo clams during certain times of the year.
- *Reserves* are designated, and their uses and boundaries periodically amended, by the Fish and Game Commission in ocean waters along the California coast to restrict commercial and recreational fishing. The DFG's Ocean and San Francisco Bay District manages these areas.
- *State Estuaries* have been designated at Morro Bay and San Diego Bay in recognition of the resource values of these sites and to facilitate the development of water quality management programs for these areas. A management plan for Morro Bay, recently designated a National Estuary, and its watershed are mandated to be developed and submitted to the State Legislature on or before July 1, 1997.
- *State Parks, State Recreation Units (including State Recreation Areas, State Beaches, Wayside Campgrounds, and Underwater Recreation Areas), State Historic Parks, State Seashores, State Reserves, State Wildernesses, Natural Preserves and Cultural Preserves* are part of the State Park System and designated to provide recreational opportunities and resource protection. These areas are designated by the Park and Recreation Commission (with the exception of State Seashores, which are designated by the Legislature) and are managed by the Department of Parks and Recreation.
- *State Wildlife Areas* are designated by the Fish and Game Commission and managed by the DFG for propagating, feeding and protecting birds, mammals, and fish. Multiple recreational use of such areas is encouraged by the Commission, although only minimal facilities can be provided for activities other than hunting and fishing.
- *The UC Natural Reserve System* sites are designated to help manage and preserve the state's natural diversity to meet the University of California's teaching and research needs in disciplines that require field work.

Local Government Ocean and Coastal Managed Areas. Local governments play an important role in managing ocean and coastal areas along the coast. Some areas are directly managed by local governments, such as the Seal Rock Reserve (City of San Diego), the Bolinas Lagoon Nature Preserve (Marin County), and the Big Lagoon County Park (Humboldt County). In other coastal areas, local governments frequently have agreements with the State or federal government to help manage ocean or coastal areas.

Fishery Resources

Managing California's ocean and coastal fishery stocks at sustainable levels is complex and depends on such things as accurately assessing wild stocks and judging the impacts that multiple harvesters have on a resource. Funding limitations have made it difficult to assess the full impact of all fishery activities (particularly sport fishing), but the available information indicates that some fishery stocks are substantially stressed and declining, while others remain at sustainable levels. Determining the cause of stock declines and implementing solutions is challenging for managers attempting to assess the health of California's fishery stocks, involving analysis of habitat modifications, weather conditions, fishing practices, and water quality conditions. But, reversing these declines is important as California's fishing industry is substantial, ranking fourth in the nation in total seafood landed for 1991, while Californian's consume more seafood per capita than the national average (California Seafood Council). Declining fishery stocks have especially put substantial economic hardship on Northern California communities.

Much concern has been raised regarding the enforcement of fish and game laws (and related federal statutes) intended to maintain fishery stocks at sustainable levels. The Governor's 1997-98 Budget includes \$3.7 million in added funding for enhancing law enforcement operations and better equipping

Department of Fish and Game wardens with the tools they need to enforce California's fish and game laws. The Department has also entered into several partnership agreements with other State and federal agencies, and in some cases private entities, to increase enforcement of a wide variety of marine protection laws - including those dealing with maintenance of fisheries stocks.

Fisheries management and allocation issues are addressed by the DFG, Fish and Game Commission (FGC), California Legislature, and U.S. Department of Commerce's NMFS and Pacific Fishery Management Council (PFMC). The DFG is mandated to balance the protection of marine resources with the needs of the commercial and recreational fishing industries to maximize their long-term fishery yields. The FGC has the authority to set policy for sport fisheries, some commercial fisheries (such as anchovy, mackerel, and herring), and kelp harvesting. Policy issues not determined by the FGC are addressed through the enactment of new legislation. The NMFS is responsible for assessing fishery stock size, determining sustainable harvest rates, and evaluating habitat constraints for federally managed species. As a regional body funded through the Department of Commerce, the PFMC primarily develops, monitors, and revises management plans for fisheries between 3 and 200 miles of the U.S. coast.

Determining Fishery Stock Abundance. The DFG relies substantially on landings data reported by commercial fishermen, commercial sport fishing vessels, periodic surveys of other recreational fishery segments (fishing from private vessels, beaches, banks, piers, jetties), and occasionally through independent research to assess fishery populations for management purposes. Independent research is generally cost-prohibitive for State agencies and, therefore, usually unavailable for assessing fishery stocks.

Landings and catch-per-unit effort data over the past half century indicate that many populations of fish and shellfish species continue to annually decline and/or widely fluctuate, while some others, such as California sardine, Pacific mackerel, California barracuda, and California halibut, have responded positively to "take" restrictions. For example, Pacific ocean shrimp landings in 1992 were higher than any landings over the past 41 years off California's coast. Other fisheries being managed at sustainable levels include the spiny lobster, squid, and the north coast Dungeness crab population. (Rao, pers. comm.). Important stocks of continuing concern include abalone, salmon, albacore tuna, thresher sharks, and red sea urchin. Total pounds of all fish and shellfish landed in 1992 alone declined 18% over the previous year, although landings were up 5% in 1993. (Collins, pers. comm.). Reasons for declining harvest rates for some fish stocks are a combination of many factors, including:

- loss of habitat for feeding, nursery, and spawning purposes due to the modification of waterways, diversion of water flows, and loss of wetlands;
- degraded ocean and coastal water quality from sewage outfall, and nonpoint source runoff (municipal, agricultural, and industrial sources);
- natural events, such as drought, flooding, and El Niño (a wind and warm water current phenomenon which adversely affects ocean productivity); and,
- advancements in fishing technologies and overfishing. (Denisoff and Rote 1991; Mall, pers. comm.)

Some caution is required when using landing data alone to estimate fluctuations. For instance, catch declines may reflect the decisions of fishermen or processors to shift to other fishing grounds or species and may not reflect actual declines in populations. In addition, it can be difficult to obtain a complete picture of the impact from sport fishing, particularly in Southern California where there is a relatively high number of sport fishing enthusiasts, generally favorable weather conditions, and greater accessibility to the resource with many vessels and shore-based facilities available. Another important tool for evaluating fishery stocks is catch per unit of effort (CPUE, usually in pounds/hour) to indicate fluctuations in fish or shellfish abundance. This measurement tool has been controversial with some members of the fishing

community because compliance with regulations and other factors may reduce catch per unit effort and result in data which may incorrectly point to stock reductions. The DFG acknowledges that some limitations in the use of CPUE exist, but believes that it is still a valid tool in most instances for determining trends in stock abundance (Schafer (b), pers. comm.).

Salmon - An Example of a Fishery of Concern. Management decisions by the PFMC regarding ocean salmon are based on annual predictions of pre-season abundance of key stocks and specific spawning escapement goals for those stocks. Chinook (king) salmon is the dominant species in California's ocean salmon fisheries with Coho (silver) salmon generally making up a much smaller portion of the catch. Efforts are currently underway to address the substantial decline in the Coho populations along the California coastline. The two primary stocks whose pre-season abundance are used to manage California's ocean salmon fisheries are Sacramento River fall Chinook and Klamath River Basin fall Chinook. Other Chinook salmon stocks that are much less abundant but still affected by the ocean fisheries are Eel River, San Joaquin, Sacramento and Klamath spring Chinook, and Sacramento winter Chinook (an endangered species).

The early 1990s saw a significant decline in salmon abundance not only in California, but also Washington and Oregon. In California, the extended drought and existing water management practices resulted in poor spawning and rearing conditions. Ocean conditions such as El Niño placed additional strain on salmon and the combination resulted in record low stock abundance. The long-term effect of this decline in salmon abundance, especially Klamath basin stocks, has been the total absence of commercial fishing in California ocean waters north of Shelter Cove since 1991. Ocean conditions off California significantly improved for salmon in 1993, and 1992 signaled the end of the seven-year drought. The combination of these two events may explain the dramatic resurgence of salmon with the exceptionally large 1992 class of fall Chinook. Catch of these fish in the ocean fisheries, especially the ocean recreational fishery, made 1995 one of the best years on record for California's ocean salmon landings. This exceptional abundance also resulted in large fall spawning escapements into California's major river systems.

The long-term trend of Chinook stocks is unknown. A recent peak in escapements and landings does not constitute a recovery, although it is encouraging. Ecosystem management combined with many planned and ongoing actions to rebuild salmon stocks may bring them back to historic levels, but careful monitoring and detailed data gathering over the next few years will be necessary for managers to determine whether substantial long-term progress is being made in the recovery of salmon stocks in California waters.

Actions To Rebuild Fishery Stocks. A variety of efforts have been initiated to help rebuild anadromous fishery stocks and the habitats upon which they depend. Such actions to rebuild California fishery stocks include riparian habitat restoration or enhancement, ensuring adequate stream flows at critical times of the year, limiting user group access to fisheries or instituting take restrictions, specifying acceptable harvesting methods and gear types, rebuilding threatened wetland and subtidal habitats, creating artificial biomass producing reefs, and supplementing populations through hatcheries.

An example of ongoing habitat restoration and fishery protection programs is a cooperative effort in the Central Valley between the DFG, California Department of Water Resources (DWR), and U.S. Bureau of Reclamation, as well as other State and federal agencies. Using funds provided by contractors with the State Water Project, the DWR and DFG have restored spawning gravel in areas of the Tuolumne and Merced rivers for the benefit of fall-run Chinook salmon, exchanged water in Mill Creek (a tributary of the Sacramento River) to benefit spring-run Chinook salmon, and placed over 100,000 cubic yards of spawning gravel into the upper Sacramento River near Redding for the benefit of all runs of salmon and steelhead. The DFG has completed hundreds of fish habitat restoration or enhancement projects for salmon, steelhead trout, American shad, and striped bass.

In November 1993, the DFG released a document titled, *Restoring Central Valley Streams: A Plan for Action*. This restoration plan encompasses all Central Valley waters accessible to anadromous fish, excluding the Sacramento-San Joaquin Delta; documents that salmon and steelhead spawning habitat has been greatly reduced from the approximately 6,000 miles that existed prior to the construction of dams to less than 300 miles; and provides a set of priorities to begin improving these remaining habitats. It is estimated that the actions recommended for implementation will cost approximately \$350 million. The DFG, with various partners, has begun implementing some of the major projects recommended, including permanent structural temperature control devices at Shasta and Whiskey Town dams and other measures to control temperatures in the upper Sacramento River, measures to minimize anadromous fish passage problems at the Red Bluff Diversion Dam, and developing a plan to control effluent from the Iron Mountain Mine Superfund site until a Basin Plan is completed for the area. Additional efforts are also being pursued to re-establish spawning habitat in areas where anadromous fish habitat previously existed.

On the north coast, the DFG has approved and supervised the expenditure of \$26 million to implement over 1,200 individual habitat restoration projects since 1981. These projects have included stream bank protection, stabilization, and re-vegetation, as well as installation of structures to provide cover, scour hold, and rearing pools, and removing barriers to upstream migration. A variety of other planning processes are ongoing, such as the development of a water quality protection program for the Monterey Bay National Marine Sanctuary and the Coastal Conservancy's watershed management plans for the Klamath, Eel, Garcia, Navarro, Russian, Petaluma, Napa, Salinas, Santa Clara, Santa Ynez, Ventura, Santa Margarita and Otay Rivers and other major creeks to improve habitat.

The Governor's 1997-98 Budget proposes a \$3.8 million Watershed Initiative to assist the Department of Fish and Game, the State Water Resources Control Board, the Department of Conservation, and the Department of Forestry and Fire Protection in efforts to reduce water quality and habitat impacts in key watersheds throughout the State of California. This Initiative seeks comprehensive, watershed-specific prescriptions that can be used by State and federal regulatory agencies to comprehensively mitigate the effects of adverse environmental impacts in key watersheds. In these watersheds, the Initiative will integrate management, groundwater protection, and other programs across State government to promote more efficient use of personnel and fiscal resources. It will rely on prompt, but thorough, watershed and wildlife assessments to establish priorities and practices to protect all of the environmental assets in a given watershed.

At the federal level, the 1992 Central Valley Project Improvement Act (CVPIA) provides several possible approaches to remedy the decline of anadromous fish species. The CVPIA establishes federal goals for ensuring adequate stream water flows to protect all life stages of anadromous fish. It also requires programs to mitigate for fishery impacts resulting from water pumping facilities, including such specific measures as installing temperature control devices at dam structures and increasing the availability of spawning gravel.

The CalFed Bay-Delta Program is a cooperative effort among State and federal agencies and the general public to develop a long-term comprehensive plan for restoring the ecological health of the San Francisco Bay/Sacramento-San Joaquin Delta estuary (Bay-Delta) and the many key streams in the watershed. A three-phase process, the Bay-Delta Program also seeks to improve water management for beneficial uses of the Bay-Delta system. Phase I of the Program defined the Bay-Delta problems, established Program objectives, and identified actions that could resolve these problems and meet the objectives. In addition, strategies were developed to identify, assemble and refine three alternatives, each of which is a combination of actions that together address the critical problems affecting the Bay-Delta. Each alternative includes common programs for water use efficiency, ecosystem restoration, water quality, and levee system integrity; a range of water storage options; and a system for moving water throughout the State. Phase II will include further refinement of the three alternatives, preparation of a programmatic environmental impact report/statement (EIR/S) to address the potential environmental implications of each alternative, and identification of a preferred alternative. Upon certification of the EIR/S, Phase III site-specific environmental review of individual elements and project implementation can begin. Voters in

California's November 1996 election overwhelmingly passed a \$995 million bond measure, which is intended in large measure to fund ecosystem restoration efforts identified by the CalFed program.

A multi-state regional effort, the Pacific Fisheries Legislative Task Force was formed in 1985 as a mechanism for addressing Pacific fisheries, aquaculture and seafood issues. California, Oregon, Washington, Alaska, Hawaii and Idaho all passed resolutions through their state legislatures to become formal task force members. Each state appoints two senators and two representatives or assemblymembers as official task force members. The task force has played an active role in banning the use of high seas drift nets, banning the use of tributyltin (TBT) in vessel bottom antifouling paints, and addressing ballast water issues. This kind of state government interaction is an important tool in ocean resource management. Six tasks are integrated into the task force bylaws:

1. Advocating actions needed for healthy fisheries in the Pacific states, for both present and future generations.
2. Overseeing federal, interstate and international fishery agencies with jurisdiction affecting participating states, including regional fishery management councils, fishery and seafood development foundations, and the Pacific Marine Fisheries Commission.
3. Monitoring congressional actions of importance to the Pacific states' fisheries.
4. Fostering cooperation among the Pacific states and their fishing industries on legislation and other matters affecting common fishery concerns.
5. Serving as a clearinghouse for information and opinions from all the interests involved in Pacific states' fisheries.
6. Reporting to the legislatures of participating states and their congressional delegations on means of protecting and fostering Pacific fisheries.

Economic Hardships. North Coast fishing communities have been affected by severe declines in salmon populations in recent years. Governor Wilson responded to the hardships faced by these communities by declaring a State of Emergency on May 20, 1994. This declaration helped make financial resources available to families and small businesses that were hard-hit by salmon declines. A Federal Disaster declaration was then issued by the President pursuant to a request by California, Oregon, and Washington. The declaration is providing assistance to these West Coast communities through Small Business Administration loans, Disaster Unemployment Assistance, Department of Commerce funding assistance for habitat restoration projects, and a Pacific States Marine Fisheries Commission sponsored data collection program.

California's Marine Aquaculture Industry

Aquaculture is the practice of culturing, growing, and harvesting an aquatic species in a controlled setting. As an emerging California industry, aquaculture holds the potential to supplement the growing demand for fresh seafood and aquatic products, as well as assist with re-stocking programs. California has approximately 400 registered aquaculturists who raise products within intensive systems (enclosed, or on land). Approximately 25% of registered aquaculturists contribute between \$45-50 million to the California economy, with catfish, oysters, and trout the top producing species. Other marine species include abalone, striped bass, sturgeon, mussels, scallops and clams. (Hulbrock, pers. comm.).

Stocking of ocean and coastal environments with cultured fish has shown some success with salmon, as well as other species with small pilot projects in other states. California is currently involved in a pilot program to introduce white seabass in Southern California nearshore ocean waters. Other potential applications could include such species as abalone, sea urchin, sturgeon, and halibut. However,

questions regarding ecosystem effects, carrying capacities, and species interactions should be investigated before large scale rebuilding projects for new species are undertaken. An important question is that of maintaining genetic diversity in marine species released from hatcheries. If the intent of the hatchery releases is to not modify wild stocks, then careful monitoring must be undertaken to ensure that the genetic make-up of hatchery fish matches that of the wild stock.

Marine Mammal Populations

Efforts to protect and restore marine mammal populations off the California coast have resulted in substantial increases in several of these populations, while others continue to recover. The rebound in many populations is encouraging and likely the result of efforts by government, industry, and non-profit organizations to protect these species and their habitats. It will be important to closely monitor these populations as they may eventually increase far beyond historic populations and environmental carrying capacities. As marine mammal and human populations both continue to increase, more frequent interactions are occurring with both positive and negative results.

At Pier 39 in San Francisco Bay, California sea lions have virtually taken over a section of boat slips within clear view and access of shops and restaurants. Initially discouraged from using these dock facilities, up to 500 sea lions at a time have occupied the site and become a significant tourist attraction, resulting in increased tourism-related revenues in the area. Commercial fishermen and party boat owners, on the other hand, complain that the marine mammals frequently steal their catch, resulting in economic losses. Legal methods are available for discouraging marine mammal predation of fishery catch, but sport and commercial boat operators frequently report little success in their use. At the same time, the general public supports protections for marine mammals irrespective of the fact that the populations of some species may have reached or exceeded their historic population size.

Ocean resource managers are further challenged by the successful expansion of sea otters into additional historic range, made possible in large part by efforts of the USFWS and other government agencies to protect and expand the population. Conflict arises because sea otters can adversely affect commercial and recreational shellfish fisheries with their voracious appetites. Marine mammals are naturally attracted to food sources, such as sea lions are to salmon, and research efforts are ongoing to develop non-lethal means of discouraging marine mammal interactions with such fisheries.

Another challenge is elephant seals expanding into previously unoccupied range on beaches with direct human contact. Elephant seals historically avoided mainland sites due to the threat of attack from grizzly bears and humans, but now exhibit little fear without natural predators. In addition to the world famous breeding site at Point Año Nuevo in San Mateo County, new colonies are expanding rapidly at Point Reyes in Marin County, Piedras Blancas in San Luis Obispo County, and other mainland locations. The dilemma for managers is how to protect these animals from humans and protect people from the hazards presented by several thousand-pound mammals which appear relatively immobile, but can actually move faster than many people can run. Tourists have been known to put their children on or next to these animals, which could have tragic results.

Whether to take measures to contain marine mammals within their current or historic range to protect fisheries or how to manage increasing interactions between humans and marine mammals are important issues which must be addressed as populations continue to increase. Clearly new elephant seal breeding sites could provide superb tourist opportunities, but they must be supported by proper management and education to ensure the safety of animals and visitors alike. With marine mammals remaining under federal authority, California continues to assist federal agencies in the study and management of these and other marine mammal issues. California also has an important role in major management actions through the federal consistency review process.

For instance, actions by the NMFS, USFWS, or National Biological Service which "affect the coastal zone" are subject to determinations of federal consistency with California's Coastal Management Program

administered by the California Coastal Commission. Examples of some past federal consistency actions by the Coastal Commission include the translocation of sea otters to San Nicholas Island from the Central California coast to reduce oil spill risks to the population, and moving sea lions from Washington State to Southern California to eliminate predation on key Salmon runs. Although novel approaches, neither of these actions provided long-term solutions to marine mammal problems due the strong instincts of these animals to return to their home ranges.

Non-Native Plant and Animal Species

Many of California's coastal habitats, including beaches and dune areas, marshes, mudflats and open waters, have been invaded by non-native plant and animal species. On land, a significant problem has been the introduction and establishment of European dune grass, which has displaced many native species and important habitats. The best studied non-native aquatic species are in the Bay-Delta, which was the subject of a two-year study on introduced aquatic species submitted to the USFWS (Cohen 1995). The study documented 212 non-native aquatic organisms established in the Bay-Delta, with hundreds more being evaluated to determine their origin. Overall, the study found the average rate of invasion since 1850 has been one new non-native species established in the Bay-Delta every 36 weeks. Furthermore, the rate has been increasing, with an average of one new species every 24 weeks in the period since 1970. Non-native aquatic species are also commonly reported in Los Angeles, San Diego and many smaller harbors and embayments.

Environmental and Economic Impacts of Non-Native Aquatic Species. Introduction and establishment of these organisms has resulted in many negative ecological and economic effects. Through predation and competition, introduced species have contributed to the extinction or regional eradication of some native species and dramatic reductions in others. The Bay-Delta's food webs have been dramatically altered, most recently by the arrival of an Asian clam which has multiplied to such abundance that it can filter all the water over a significant portion of the San Francisco Bay in less than a day, removing bacteria, phytoplankton and zooplankton in the process and leaving little behind for other organisms. Introduced cordgrasses threaten to take over much of the Bay-Delta's mudflat areas, which today are key winter feeding sites for millions of migratory shorebirds on the Pacific Flyway. One introduced shipworm alone caused an estimated \$615 million (1992 dollars) in damage to wharves, piers, ferry slips and other structures between 1919 and 1921. Hull fouling, primarily from introduced aquatic species in the Bay-Delta, often reduces the speed and increases the fuel consumption of boats and ships by 15 to 50 percent. The State of California has spent approximately \$400,000 per year to control non-native plants in the Delta, and over \$1 million on an effort to keep an exotic fish from reaching the Delta. For these reasons the California Department of Water Resources (as manager of the State Water Project), Association of California Water Agencies (representing many of California's water users) and numerous other organizations have voiced increasing concerns about non-native species in the Bay-Delta and throughout California.

Methods of Introduction for Aquatic Species. The main method for marine and estuarine species introduction today is ship ballast water. A modern day cargo ship may take on enormous quantities of water to achieve proper buoyancy and trim, later discharging that water in another port, perhaps thousands of miles from its source, before taking on more cargo. Ballast water can contain numerous species of phytoplankton, zooplankton, and the eggs, larvae or adults of clams, crabs, shrimp, worms and other marine species in great abundance, so that within a few hours tens of millions of living exotic organisms may be de-ballasted from a single ship. The federal government prohibits ballast water introduction of exotic estuarine and freshwater organisms into the Hudson River and Great Lakes by requiring mid-ocean exchange of ballast water from foreign ports in a program implemented by the Coast Guard. These controls were a response to the invasion of the European zebra mussel in the Great Lakes, and the discovery of the cholera pathogen arriving in U.S. ports via ballast water from South America. For all other U.S. ports and vessels equipped with ballast water tanks, the Congress enacted the National Invasive Species Act of 1996 (House Resolution 4283), which requires the establishment of voluntary national guidelines for ballast water exchange. The guidelines are to direct vessels entering U.S. waters to

exchange ballast water beyond the U.S. exclusive economic zone, where the exchange poses no threat of infestation or spread of nonindigenous species, or to use other environmentally sound ballast water management methods. If at any point the Secretary for Commerce determines that compliance with the act is inadequate, the Secretary is required to promulgate regulations with mandatory requirements. The legislatures of California, Oregon, Washington, Alaska, and Hawaii have all considered or passed laws and resolutions regarding ballast water control.

Organizations Addressing Ballast Water Exchange. Several organizations are addressing the issue of ballast water exchange. Organizations such as the American Society for Testing and Materials, National Research Council's Marine Board (Marine Board), and technical committees of the International

Maritime Organization (IMO) are actively involved in the preparation of specific recommendations for possible implementation by the U.S. Congress and/or IMO. Actions taken have included:

- *American Society for Testing and Materials (ASTM).* In May of 1995, ASTM issued a draft standard for ship ballast water management which applied to open ocean exchanges where the water initially taken was either fresh water or brackish water. However, it did not address safety issues associated with such operations and the final standard released has drawn attention from naval engineers with the U.S. Coast Guard. The final standard has not moved forward pending resolution of issues around hull stress on ships involved in open ocean transfers.
- *Marine Board.* The Marine Board has convened a committee to prepare a report and recommendations regarding management measures and technological control procedures for preventing unintentional introductions of non-native aquatic nuisance organisms through ballast operations.
- *U.S. Congress.* On November 4, 1992, the U.S. Congress amended the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (16 U.S.C. 4711[b]) to specifically address the Hudson River area. The National Invasive Species Act of 1996 extends voluntary guidelines for ballast water exchange to all other U.S. waters and allows up to \$750,000 in grants for research on aquatic nuisance species prevention and control in the Bay-Delta and another \$500,000 in grants for the Pacific Coast.
- *International Maritime Organization.* The IMO currently requires the reporting of mid-ocean exchanges of ballast water, and is considering whether to make such exchanges mandatory. Issues regarding the structural integrity of ships engaged in ballast water exchange and safety of open ocean exchange activities must be addressed prior to any such requirement being imposed.

FINDINGS AND RECOMMENDATIONS

Finding

Ocean resource management and policy-making is often hampered by insufficient information about habitat functions and values, species diversity, and other complex physical, biological, and chemical processes, and interactions which affect the ocean ecosystem. Understanding the natural and anthropogenic factors that affect ocean productivity and health, and their interrelationships, is essential to establishing sustainable ocean resource management policies and determining their effectiveness, both short-term and long-term. New information sharing and data consistency approaches being established by groups such as the California Biodiversity Council, Southern California Wetlands Working Group, Monterey Bay National Marine Sanctuary, and Santa Monica Bay Restoration Project will provide important models for ecosystem-based management of California's ocean ecosystem.

Recommendation A-1. *Complete resource inventories within bays, estuaries, and coastal lagoons along the California coast, as well as within the waters offshore the California coastline, and make this data accessible through the California Environmental Resources Evaluation System (CERES).* A key objective should be to work with federal agencies, including the Departments of Commerce, Interior, Transportation and Defense, to assist the State in developing this information. The proposed Ocean Resources Management Coordinating Council (see Chapter 6) should help identify information sources, prioritize these efforts, and determine the most important data and information for ocean resource management needs still missing in California.

Finding

California's ocean ecosystem supports a wide assemblage of ocean and coastal life that includes plants, invertebrates, fish, birds, and mammals. The health and productivity of this ecosystem is, and will continue to be, important to public health, species diversity, and ocean-dependent industries including the State's substantial tourism and recreation, and commercial and recreational fishing. Ecosystem management strategies are likely to be most effective in maintaining these important ocean and coastal resources.

Recommendation A-2. *Ecosystem management strategies and supporting research which demonstrate more effective and/or efficient approaches to resolving ocean management issues should be given financial priority for planning and implementation.* These strategies should be developed in consultation with all interested parties under the guidance of the proposed Ocean Resources Management Coordinating Council, and in consultation with the California Biodiversity Council. Ecosystem strategies must include approaches that consider the interdependence of species and habitats located within California's four ocean resource zones, the multiple jurisdictions and stakeholders concerned with these resources, and the efficiency of program planning and implementation measures.

Finding

The array of California's ocean and coastal managed area designations is complex and often confusing, posing questions as to the effectiveness and enforceability of designations meant to safeguard the State's ocean and coastal biodiversity and to promote public use and enjoyment of these resources. The existing categories of State ocean and coastal managed areas along the coast and in State Tidelands have generally evolved on a case-by-case basis through legislative and administrative actions and by public referendum. These designations have not necessarily conformed to any plan designed to establish managed areas in the most effective way or in a manner that ensures that the most representative or unique areas of the ocean and coastal environment.

Recommendation A-3. *Develop a more effective and less complicated statewide system of ocean and coastal managed areas.* A comprehensive program is needed, with clear criteria for creating, administering, and enforcing management measures in these specially designated areas. Key tools will be the information about marine managed areas provided in Appendix H and the database and GIS mapping project for California marine protected areas being completed by the Sea Grant Extension Program and UC Santa Barbara.

Finding

Some of California's important ocean and coastal fishery stocks are currently reduced and could benefit by additional measures to sustainably manage them. Factors contributing to declines are complex and include the loss of inland and coastal spawning habitat, water pollution, natural events like drought and El Niño, and overfishing. Watersheds and their inland and coastal streams have been adversely affected by increased urbanization, agricultural practices, forestry operations, modification of waterways, and altered water flows. The status of several fish populations is difficult to assess due to the cost and consequent lack of monitoring and assessment information upon which to base sound management decisions. Conflicts between sport and commercial fishing interests, combined with different management systems for the two industries, has limited the ability of these industries to work together to resolve issues. California's marine aquaculture industry holds the potential to supplement the growing demand for fresh seafood and aquatic products, as well as assist with re-stocking programs.

Recommendation A-4. Establish additional comprehensive long-term approaches for sustainably managing California's ocean and coastal fishery stocks, with an emphasis on re-building stocks in decline. The proposed Ocean Resources Management Coordinating Council can provide an important link between the Legislature, Fish and Game Commission, and commercial and sport fishing interests regarding habitat and resource management issues that affect both industries. Strategies should be developed in close cooperation with these and other interested parties, and should include:

- effective proposals for improving enforcement of fisheries and environmental regulations that will better sustain fishery stocks off the California coast;
- enhanced utilization of expertise located within the Department of Fish and Game, as well as other public, private, and non profit institutions, to assist the Fish and Game Commission and the Legislature in the management of fishery stocks;
- aquatic species restoration and management projects, water temperature and flow control devices, spawning and nursery ground restoration, the use of hatcheries, and biomass producing artificial reefs, while also considering harvest refugia, individual transferable quotas, and other means, to rebuild fishery stocks to sustainable levels;
- improved cataloging of fisheries stock information and plans for generating new information sources, such as independent field research, which does not rely exclusively on fishery catch data; and
- potential use of aquaculture as a supplement for fresh seafood and aquatic products, as well as to assist with re-stocking programs.

Recommendation A-5. Establish a comprehensive long-term approach for California marine aquaculture development, identifying opportunities and constraints for this industry which can provide an alternative source of certain seafood products. This approach should consider:

- the current permit process for aquaculture operations and how duplication in permitting procedures can be reduced through the use of master CEQA documents or other procedures;
- the water quality standards necessary to support aquaculture operations and the industry's role in achieving and maintaining this level of water quality; and
- the need to encourage new research for supporting aquaculture.

Finding

Efforts to protect and restore marine mammal populations off the California coast have resulted in substantial increases in some of these populations. Increases in both human and marine mammal populations have led to more frequent interactions between marine mammals, the public, and fishermen with both positive and negative results. For example, elephant seals are breeding in large numbers on State Tidelands and mainland locations within a National Seashore, within a State Reserve, and adjacent to private property. Management of these colonies and their interaction with human visitors is excellent in some areas, such as the Año Nuevo Reserve in San Mateo County, and in need of improvement in other areas along the coastline.

Recommendation A-6. The State of California should coordinate with federal and local agencies and other interested members of the public and private sectors to address conflicts resulting from new marine mammal population increases. Responsibility for managing marine mammals rests with the federal government, although other levels of government, the public and the private sector can play a role in addressing conflicts. Currently, increased elephant seal breeding on the mainland could provide a logical beginning for this effort. Future issues could include marine mammal and fishery conflicts that occur up and down the entire West Coast of the United States.

Finding

Many of California's coastal habitats, including beaches, dune areas, marshes, mudflats and open waters, have been invaded by non-native plant and animal species. Establishment of these species frequently has substantial negative environmental and economic consequences for resources within California's inland watershed and enclosed coastal waters zones.

Recommendation A-7. Support State, national, and international efforts to reduce the importation and establishment of non-native species and study the current effects of these species on California and other West Coast states. This is an important issue for the State of California to address as it has substantial ramifications for the health of the inland and enclosed coastal waters of California's ocean ecosystem as well as for the State's flood control and levee systems.